Repair Instructions Radiant Heater 600W

Table of contents:

3 General service instructions/service possibilities 3
3.1 General service instructions 3
3.2 Service possibilities 3
3.3 Servicing 3
4 Removal and installation of assemblies 4
4.1 Lamps 4
4.2 Heating elements 4
4.3 Electronics module 5
4.3.1 Battery 5
4.3.2 Keypad and Display PCB 6
4.3.3 Lighting switch 6
4.3.4 P.C. boards CPU and Logic 6
4.3.5 Relay PCB 6
4.3.6 Mains Input PCB with on/off switch 7
4.3.7 Transformer 7
5 Troubleshooting 8
5.1 Error list 8
5.2 Check of operating voltages 9
5.2.1 +5 V voltage supply 9
5.2.2 +15 V voltage supply 9
5.2.3 -15 V voltage supply 10
5.2.4 24 V voltage supply 10
5.2.5 a.c. voltage supply for +5 V 10
5.2.6 a.c. voltage supply for +15 V, -15 V and +24 V 10
5.3 Miscellaneous 11
5.3.1 INOP without error code 11
6 Electronic unit repair information 11
6.1 Connection diagram 11
6.2 Mains input PCB 12
6.2.1 Layout A (not in the USA) 12
6.2.2 Layout B with selected 120V mains input 13
6.2.3 Voltage selection for Layout B 13
6.2.4 Repair information / modification statuses 14
6.3 CPU PCB 15
6.3.1 Layout 15
6.3.2 Test Points 15
6.3.3 Calibration of voltage monitoring 15
6.3.4 Jumper configuration 16
6.3.5 Component configuration 16
6.4 Logic PCB 17
6.4.1 Layout 17
6.4.2 Option switches S1 for mains voltage selection 18

6.4.3 Connectors 18
6.4.4 Test points 18
6.4.5 Calibration of temperature measurement circuit 19
6.4.6 Window-comparator functional test 20
6.4.7 Functional test of battery charging circuit 20
6.4.8 Repair information / modification statuses 20
6.5 Relay PCB 21
6.5.1 PCB Relay 43 01 491 21
6.5.2 Relay PCB 83 05 951 22
6.5.3 Repair information / state of modifications 24
6.6 Display PCB with keypad 24
6.6.1 Functional test 24
6.7 Motherboard PCB 24
6.7.1 Functional test 24

7 Repair information and change status 25

7.1 Radiant Heater swivel bearing 25

8 Special test equipment for RH600 25

3 General service instructions/service possibilities

3.1 General service instructions

All the assemblies forming part of the electronics system are electrostatically sensitive (CMOS); appropriate precautionary measures are thus to be observed.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

3.2 Service possibilities

- Hospital replacement of:
- Halogen lamp(s)
- Heating elements
- Rechargeable battery
- Fuses
- p.c. boards
- Switches
- Transformer
- RAM on CPU PCB

3.3 Servicing

Inspections are to be performed every 6 months and a record kept.

The following components must be renewed at specific intervals:

Every 2 years:
- Rechargeable battery 83 01856

Every 4 years:
- Timekeeper RAM 18 28 142 on CPU PCB

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4 Removal and installation of assemblies

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4.1 Lamps

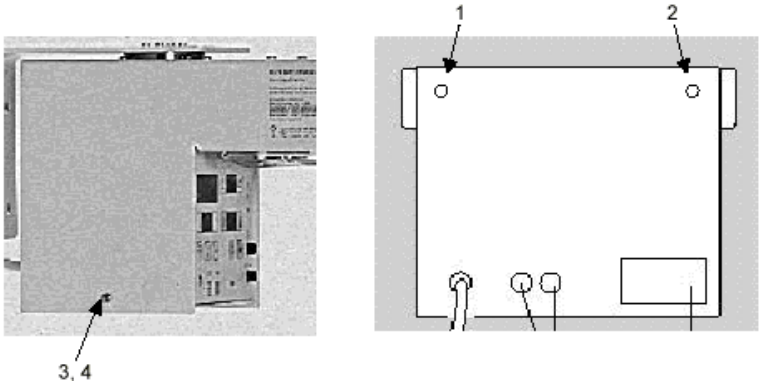
For lamp replacement, the protective mesh in front of the heating lamps is to be unscrewed (8 screws) and removed. The lamps are inserted in bayonet-type sockets and can be released by pressing them in and turning in an anti-clockwise direction.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4.2 Heating elements

- Strip down complete radiant heater from Babytherm or PP 800/8000.
- Unscrew protective mesh in front of heating lamps (8 screws).
- Detach heater and lamp holder from top of radiant heater (4 screws).
- Carefully swivel out heater and lamp holder downwards.
- Unscrew right-hand side panel from heater and lamp holder (2 screws).
- Detach connecting cable from heating lamp.
- Pull out securing plates of heating lamp (first top, then bottom).
- Please note: The 4 fixing screws of the Radiant Heater 600W shall be secured with Loctite 221 (79 01 966) afterwards.

4.3 Electronics module



The radiant-heater electronics module is attached with 4 screws to the basic housing:

- Open device by removing screws 1 to 4.
- Disconnect connectors to heater and lamps.

To effect further disassembly, the sheet-metal bracket is to be unscrewed:

- 2 screws on back (in centre),
- 2 screws on right-hand side panel,
- 2 screws on underside.

The connections for the heaters and lamps on the p.c. board "relays" must be additionally disconnected for removal of the p.c. board "relays" and the transformer.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4.3.1 Battery

The rechargeable battery is of the plug-in type and
can be pulied out to the rear.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4.3.2 Keypad and Display PCB

This module is attached by means of 4 screws to the housing of the control unit. The cable connections to the Logic PCB are coded.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4.3.3 Lighting switch

Remove keypad with the Display PCB for this purpose. The switch is attached to a bracket by means of 2 screws.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4.3.4 P.C. boards CPU and Logic

The p.c. boards "CPU" and "Logic" are secured by means of 2 screw connections.

Installation position:

- CPU PCB on outside

- Logic PCB on inside

The cable connections to the Logic PCB are coded.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4.3.5 Relay PCB

The Relay PCB is attached by means of 3 screws to the housing of the control unit.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4.3.6 Mains Input PCB with on/off switch

For this purpose, remove keypad with the Display PCB and disconnect cable connections to Mains Input PCB. The assembly is attached by means of 3 screws to the housing of the control unit.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

4.3.7 Transformer

For removing the transformer, the Relays PCB and mains connection must be detached and folded out. The transformer is attached to the housing with 4 screws.

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

5 Troubleshooting

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

5.1 Error list

After being switched on and during operation, the unit constantly carries out checks on the hardware of relevance to safety. If an error is established in this process, an error code is output on the timer display. At the same time, the INOP-LED lights up and an audio alarm is given.
The error code takes the form "Err X" with X standing for a number between 1 and 8. The error code is displayed as long as the error is present. Following the occurrence of errors, faults are likewise displayed consecutively, for example Err 4 and 5 in the event of a defective semiconductor relay.

Error no.	Meaning
1	EPROM error on CPU PCB
2	Timekeeper RAM on CPU PCB defective.
3	Short-circuit in safety relay on the Relay PCB. The test is performed following the occurrence of errors 3, 4 or 5.
4	- Short-circuit in semiconductor relay on the Relay PCB. This error is set in conjunction with error 5 following switch-on or during operation. Test: Detach connection 1 or 2 at semiconductor relay. If there is a short-circuit in the semiconductor relay, there will only be error 5 following switch-on. - No a.c. voltage supply for + 24 V, + 15 V and - 15 V; possibility of defective fuses Si 3 and Si 4 on the Logic PCB. - If errors 4 or 5 occur sporadically, upgrade SW 1.04 to SW 2.01. Refer to spare parts list.
5	Semiconductor and safety relay test. With heating switched on, a check is made as to whether current is flowing. Cause of trouble: - Heating not connected - High-impedance semiconductor relay on Relay PCB

	Test: Short circuit semiconductor relay between connections 1 and 2. "Err 4" is indicated first to be followed by "Err 5" coupled with switching noise from safety relay. - High-impedance safety relay on Relay PCB. - If errors 4 or 5 occur sporadically, upgrade SW 1.04 to SW 2.01. Refer to spare parts list.
7	Reference voltage test (Logic PCB) for temperature measurement. The voltage is outside the tolerance or the comparator is defective.
8	Mains voltage setting on Logic PCB is not plausible.

5.2 Check of operating voltages

5.2.1 +5 V voltage supply

The measurement is taken on the CPU PCB between TP 1 (+5 V) and TP 2 (GNDD). The test points can be reached without removing p.c. boards.

Refer to 6.3 for layout of the CPU PCB.

Voltage = 4.9 to 5.1 V

If there is no +5 V voltage available, check fuse Si2 on Logic PCB.

Fusing and rectification of this voltage supply are effected on the Logic PCB. The 5 V fixed-voltage regulator is attached to the inner housing bracket.

5.2.2 +15 V voltage supply

The measurement is taken on the Logic PCB between TP 17 (+15 V) and TP 4 (AGND). The test points can be reached without removing p.c. boards.

Refer to 6.4 for layout of the Logic PCB.

Voltage = +14.25 to 15.75 V

5.2.3 -15 V voltage supply

There are two possibilities as regards the measurement:
a) Logic PCB must be removed for connection of measurement leads.
b) In-situ measurement on the Logic PCB

a) The measurement is taken on the Logic PCB between TP 21 (-15 V) and TP 4 (AGND).

   Refer to 6.4 for layout of the Logic PCB.

   Voltage = -14.25 to -15.75 V

b) The measurement is taken on the p.c. board "logic" between TP 4 (AGND) and the negative connection of the electrolytic capacitor C 14 on the solder side. The capacitor C 14 is located directly behind the fuse Si4. The protective lacquer must be pierced with the test prod.

   Refer to 6.4 for layout of P.C. board "logic".

   Voltage = -14.25 to -15.75 V

5.2.4 24 V voltage supply

Available when +15 V voltage supply is available.

5.2.5 a.c. voltage supply for +5 V

The measurement is taken between fuse Si2 on the Logic PCB and the connector for the Logic PCB on the solder side of the motherboard at connection 29 a/c. The connector counting direction starts from the front.

Voltage = 9 V a. c.

5.2.6 a.c. voltage supply for +15 V, -15 V and +24 V

The measurement is taken between the fuses Si3 and Si4 on the Logic PCB.

Voltage = 40 V a. c.

5.3 Miscellaneous

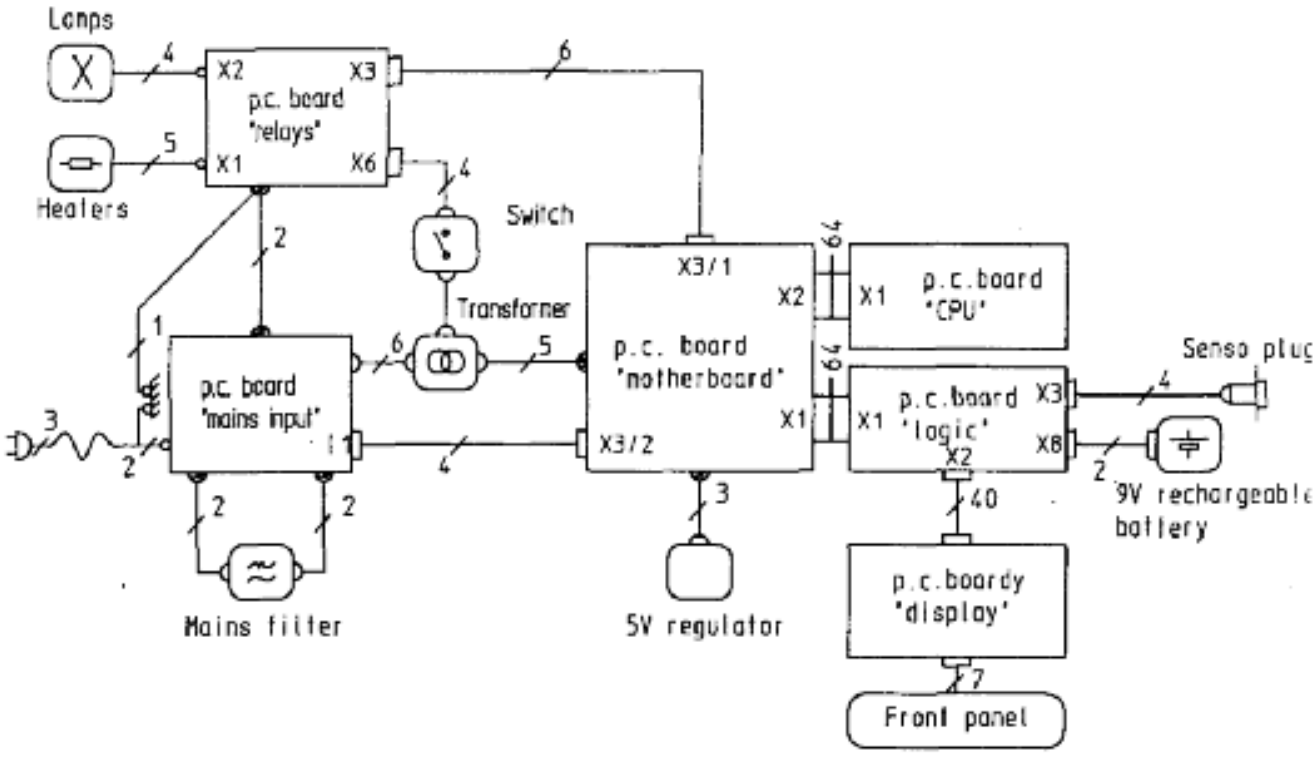
5.3.1 INOP without error code

Description of fault: INOP and power-failure LED light up and audio alarm is given. No error message and no unit function.

Troubleshooting: +5 V voltage supply defective; possibility of fuse Si2 on the Logic PCB being defective.

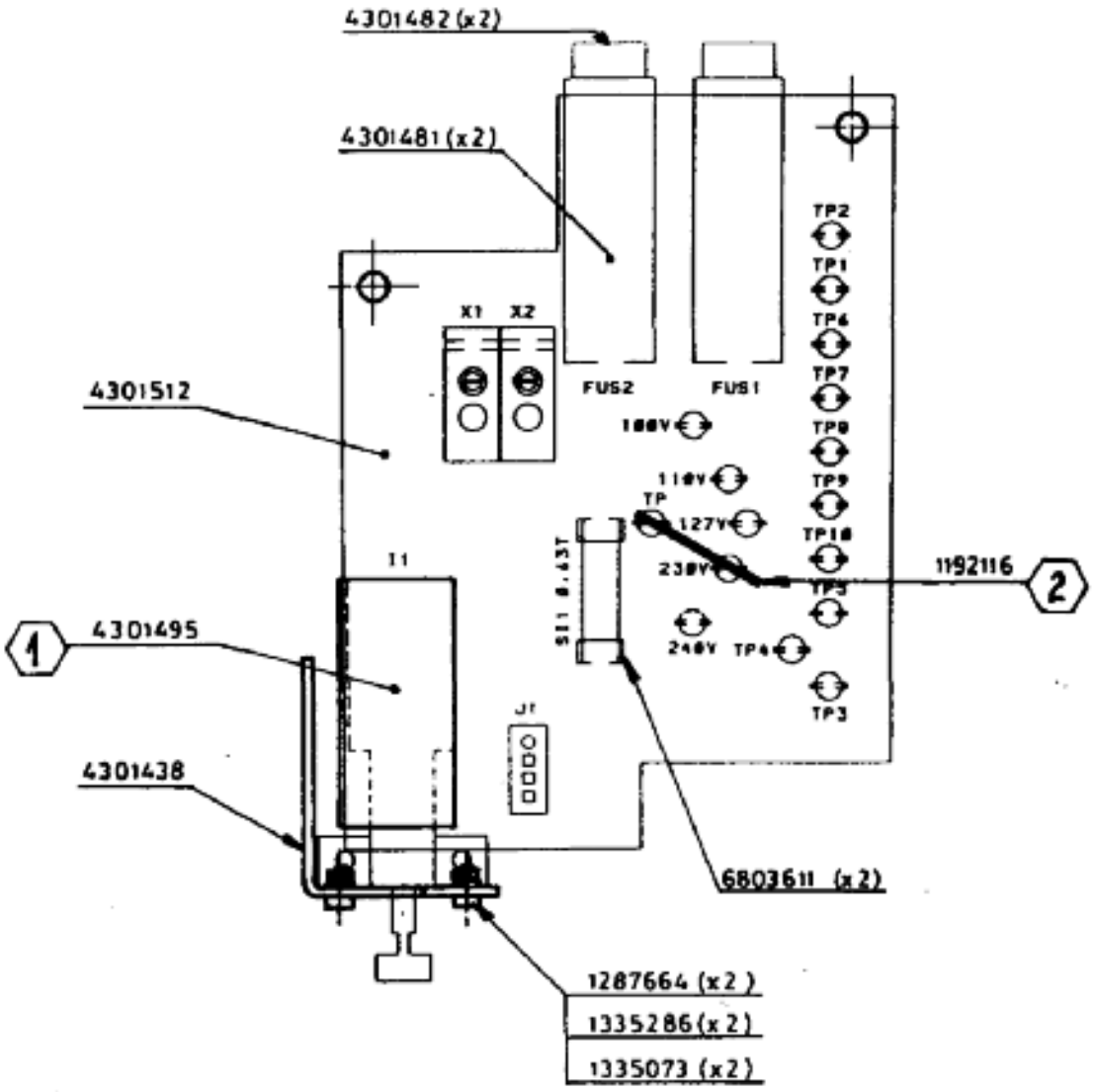
6 Electronic unit repair information

6.1 Connection diagram



6.2 Mains input PCB

6.2.1 Layout A (not in the USA)

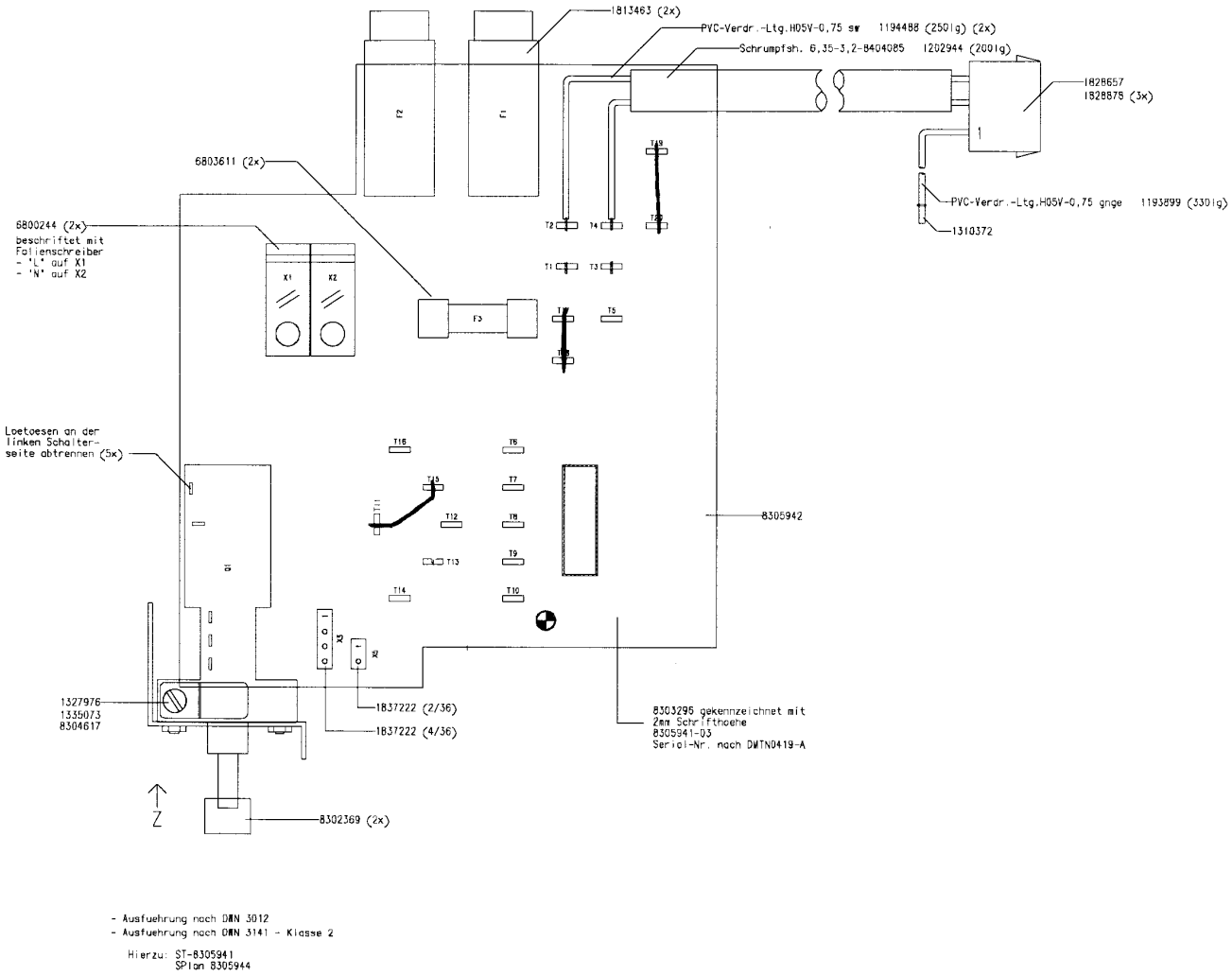


6.2.1.1 Voltage selection for version A

This p.c. board features soldering terminals for selecting the input voltage for the transformer, which supplies the electronics and the lamps. A jumper is to be soldered in between the central soldering terminal and the terminal designated with the desired voltage. The rating of the adjacent fuse Si1 is to be adapted to the voltage employed. Use is to be made for 220 - 240 V of a 0.63 A (slow-blow) fuse and for 100 - 127 V of a 1.25 A (slow-blow) fuse.

Attention is likewise to be paid to the position of the option switches S1 on the Logic PCB as regards voltage switching.

6.2.2 Layout B with selected 120V mains input



6.2.3 Voltage selection for Layout B

This p.c. board features soldering terminals for selecting the input voltage for the transformer, which supplies the electronics and the lamps. A jumper is to be soldered in between the central soldering terminal and the terminal designated with the desired voltage. The rating of the adjacent fuse F3 is to be adapted to the voltage employed. Use is to be made for 220 - 240 V of a 0.63 A (slow-blow) fuse and for 100 - 127 V of a 1.25 A (slow-blow) fuse.

Soldering jumpers for 83 05 941-03 with a relay (see label):

Mains Voltage	Voltage Selection	T17 to T18	T19 to 20	T1 to T2	T3 to T4
110 V	T11 to T16	Set	Set	Open	Open
120 V	T11 to T15	Set	Set	Open	Open
127 V	T11 to T12	Set	Set	Open	Open
230 V	T11 to T13	Open	Open	Set	Set
240 V	T11 to T14	Open	Open	Set	Set

Soldering jumpers for older versions of 83 05 941 without T17, T18, T19, T20 and without Relay:

Mains Voltage	Voltage Selection	T2 to T3	T1 to T4
110 V	T11 to T16	Set	Set
120 V	T11 to T15	Set	Set
127 V	T11 to T12	Set	Set
230 V	T11 to T13	Set	Set
240 V	T11 to T14	Set	Set

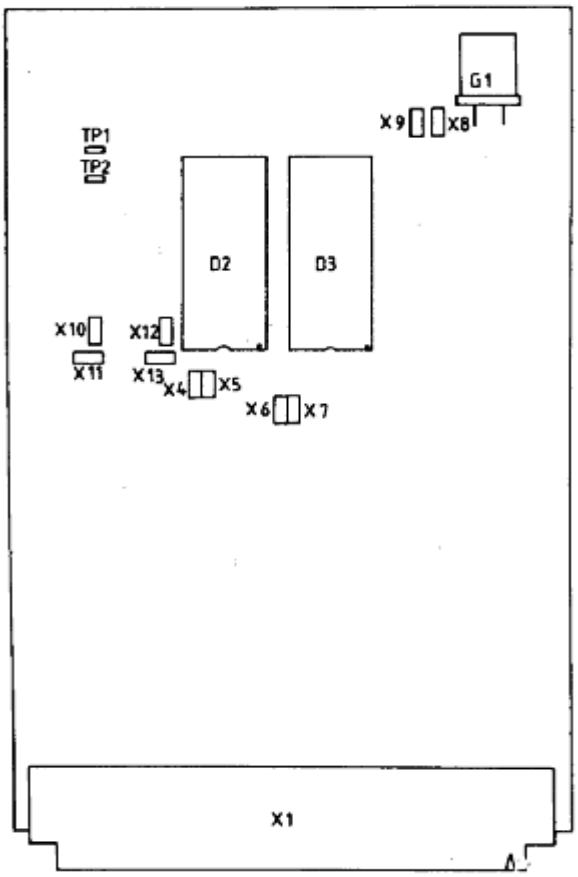
Attention is likewise to be paid to the position of the option switches S1 on the Logic PCB as regards voltage switching.

6.2.4 Repair information / modification statuses

See product improvement RH600 for the USA and Canada (120V version).

6.3 CPU PCB

6.3.1 Layout



6.3.2 Test Points

TP1 Supply voltage +5 V
TP2 GND

6.3.3 Calibration of voltage monitorinq

For this purpose, remove the CPU PCB and supply with 4.73 to 4.77 V at TP1 (+5 V) and TP2 (GND).

- Two initial conditions are possible:

  If LED lights up, turn potentiometer R0 in clockwise direction until LED goes out or glows dimly. Then turn in opposite direction until LED just lights up again. If LED does not light up or glows dimly, turn potentiometer in anti-clockwise direction until

- LED just lights up.

  On increasing voltage (never in excess of 5.5 V), the LED must go out at a voltage between 4.77 to 4.83 V or only glow dimly.

- Then secure potentionmenter with locking compound.

6.3.4 Jumper configuration

Use is to be made of the following jumper configuration:

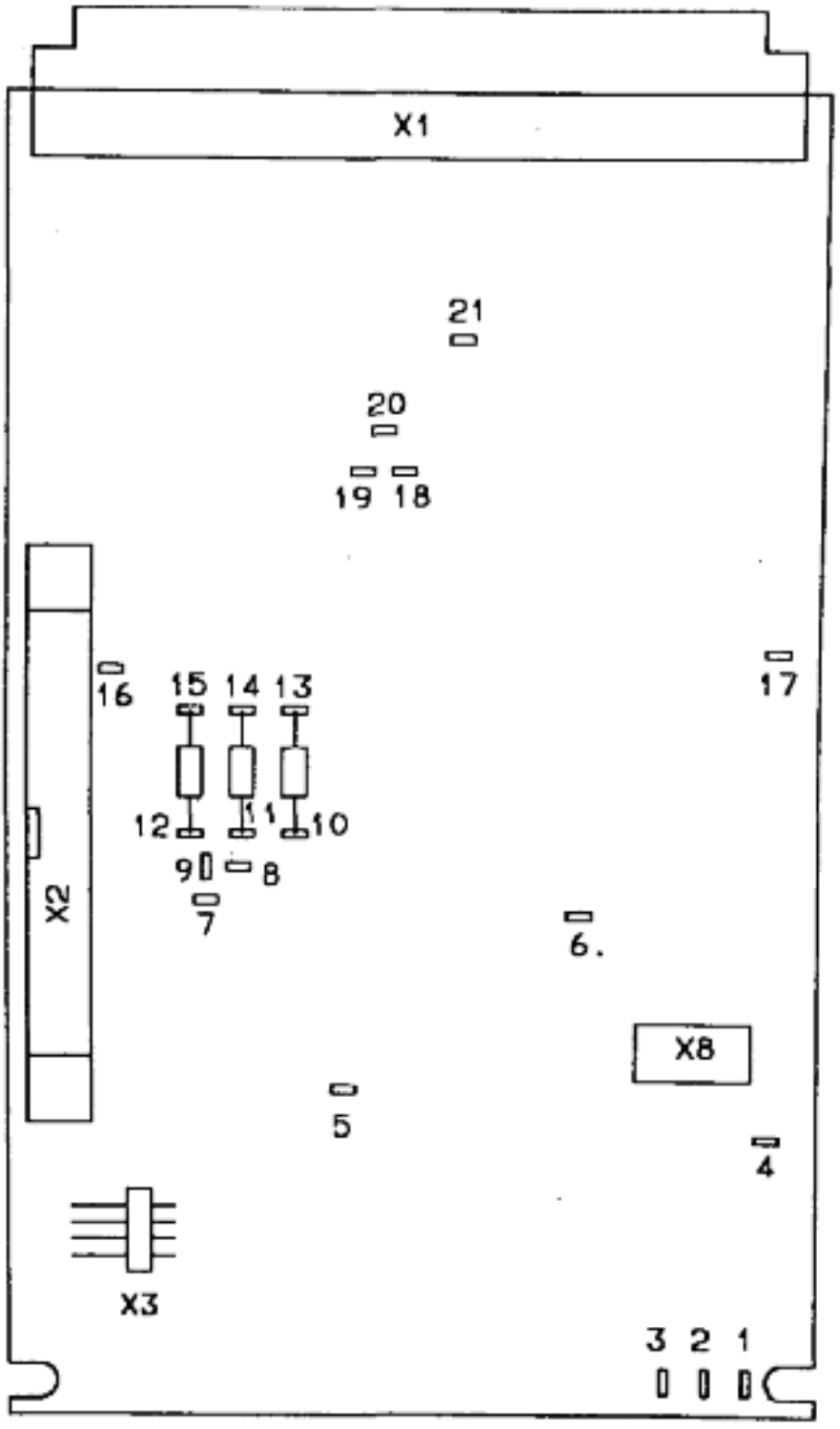
Location	Jumper	Function
X4	not used	EPROM 27256
X5	fitted	EPROM 27256
X6	fitted	RAM 2 kbytes
X7	not used	RAM 2 kbytes
X8	fitted	RAM 2 kbytes
X9	not used	RAM 2 kbytes
X10	fitted	Watchdog 1 active
X11	not used	Watchdog 1 active
X12	fitted	Watchdog 2 active
X13	not used	Watchdog 2 active

6.3.5 Component configuration

D2 EPROM
D3 Timekeeper RAM (pin 1 of module in pin 3 of frame)

6.4 Logic PCB

6.4.1 Layout



6.4.2 Option switches S1 for mains voltage selection

Switch S1	Function
1	no function
2	no function
3	No function
4	on = 100 V
5	on = 110V / 120 V (US units)
6	on = 127 V
7	on = 230 V
8	on = 240 V

As regards switches S4 - S8, one must be switched on and the others switched off. This switch position defines the power control for the heat settings in such a manner that the same heat setting achieves uniform heating power with a lower operating voltage by means of longer active phases.

6.4.3 Connectors

X1 Connection to motherboard
X2 Ribbon cable to Display PCB
X3 Flat-pin terminal to sensor socket (temperature sensor)
X8 Flat-pin terminal to 9 V rechargeable battery

6.4.4 Test points

TP 1, TP 2	Soldering jumper, otherwise no audio alarm
TP 2	Output voltage, measurement amplifier, stage 1
TP 4	Analog GND
TP 5	Output voltage, D/A converter
TP 6	Output voltage, measurement amplifier, stage 2
TP 7	Logic signal of current monitoring signal
TP 8	Voltage at reference diode
TP 9	Logic signal of sensor monitoring circuit
TP 10, TP 13	Calibration, offset, measurement amplifier (R3)
TP 11, TP 14	Calibration, gain, measurement amplifier (R1)
TP 12, TP 15	Calibration, gain, D/A converter
TP 16	Logic signal of window comparator
TP 17	Supply +15 volts
TP 18	Digital GND
TP 19	Non-regulated supply for 5 volts
TP 20	Regulated +5 volt supply
TP 21	Supply -15 volts

6.4.5 Calibration of temperature measurement circuit

- The supply voltages are to be checked prior to calibration:

  +5 V supply between TP 20 (+5 V) and TP18 (DGND)

  Voltage = +4.9 to 5.1 V

  +15 V supply between TP 7 (+15 V) and TP 4 (AGND)

  Voltage =+14.25 to 15.75 V

  -15 V supply between TP 21 (-15 V) and TP 4 (AGND)

  Voltage = -14.25 to 15.75 V

  Reference voltage between TP 8 (Z-diode voltage) and TP 4 (AGND)

  Voltage = -5.85 V to -6.55 V

Calibration of stage 1

- Measure voltage between TP 8 (-VZ) and TP4 (AGND) and note it down.
- Select R Sel. between TP12 and TP15 such that the Voltage = (VZ - 1.5 mV) +/- 0.5 mV is applied between TP5 and TP4 (AGND)
- Solder in R Sel. and check calibration
- Calculation of Voltage stage 1 output:

  Voltage stage 1 = VZ x 1411.3 / 28370.17

- Select R Sel. between TP11 and TP14 such that the calculated Voltage stage 1 +/- 0.2 mV is measured between TP3 and TP4 (AGND).
- Solder in R Sel. and check calibration.

Calibration of stage 2

- Calculation of Voltage stage 2 output:

  Voltage stage 2 = (VZ x 3.215089487) - (Voltage stage 1 x 55.33217751)

- Select R Sel. between TP 10 and TP 13 such that Voltage stage 2 +/- 2 mV is measured between TP 6 and TP 4 (AGND).

- Solder in R Sel. and check calibration

The calibration is then to be tested with a sensor simulator 79 01 236.

6.4.6 Window-comparator functional test

- Upper threshold:

  Connect up resistance of approx. 20 K Ohm between pin 7 of IC 5 and TP4 (AGND): Err 7 must be displayed

- Lower threshold:

  Connect up resistance of approx. 5 K Ohm between TP4 (AGND) and TP8: Err 7 must be displayed.

6.4.7 Functional test of battery charging circuit

Replace rechargeable battery with ampere meter: Charging current = 2.5 +/- 0.2 mA

6.4.8 Repair information / modification statuses

6.4.8.1 Replacement of Logic PCB

When replacing the Logic PCB", the option switch S1 must be set to the appropriate mains voltage (refer to 6.4.2).

6.4.8.2 List of useable Logic PCBs

Table of Logic PCBs and status:

P/N Logic PCB	Status
8306101 / SE8306101	Not useable
2M22408 / SE2M22408	Useable
2M22409 / SE2M22409	Useable
2M22383 / SE2M22383	Useable

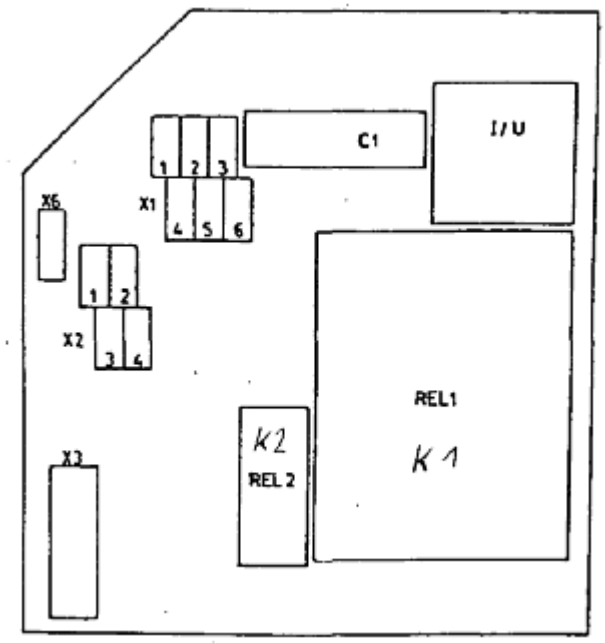
Note: If a Logic PCB with a status “not useable” is found this PCB must be replaced with a Logic PCB with a status “useable”.

6.5 Relay PCB

2 varied versions with the same function are available from this card. In the originally manufactured Relays PCB 43 01 491 the connecting cables are secured in the screw rail clips, the tension changeover is carried out by various connections of the heating cable. The cable connections of the current PCB Relay 83 05 951 have been designed as plug-in connections, the tension changeover is performed by re-soldering of jumpers.

6.5.1 PCB Relay 43 01 491

6.5.1.1 Layout



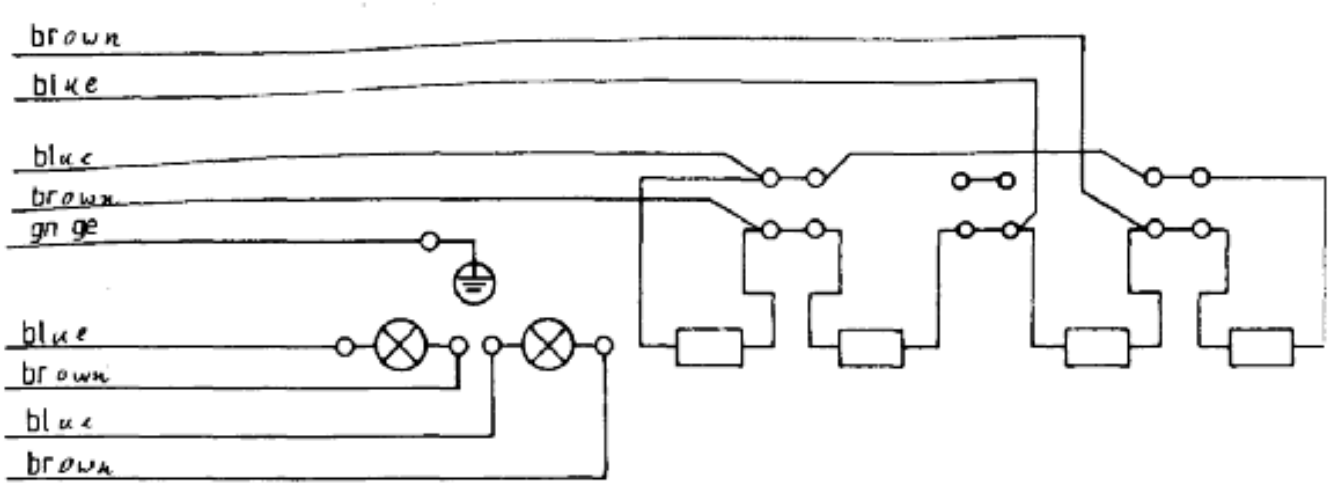
6.5.1.2 Description of connectors

Terminal X1 for connection of heating lamps:

Terminal	Function 220 to 240 V	Function 110 to 127 V
1	Protective conductor	Protective conductor
2	blue (Park position)	not used
3	blue (Park position)	not used
4	not used	not used
5	brown (Phase 1)	blue + blue (Phase 1)
6	brown (Phase 2)	blue + blue (Phase 2)

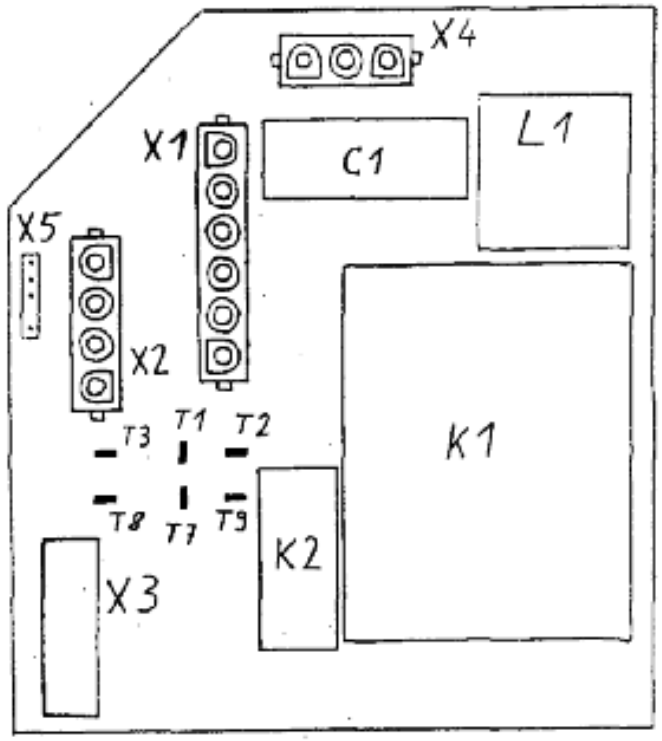
Terminal X2 for connection of two lamps:

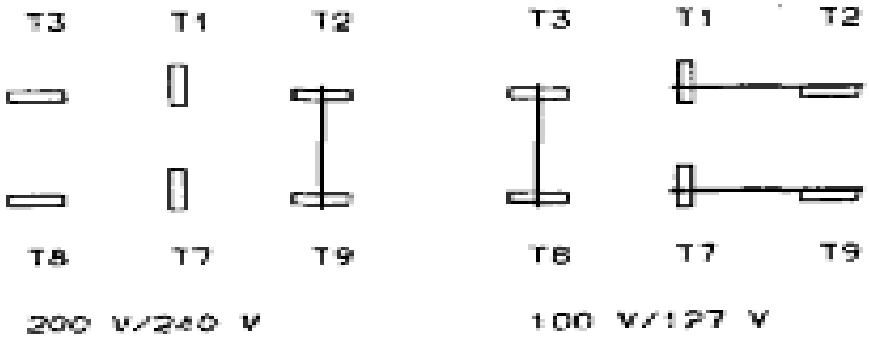
Terminal	Function
1	Lamp 1
2	Lamp 1
3	Lamp 2
4	Lamp 2



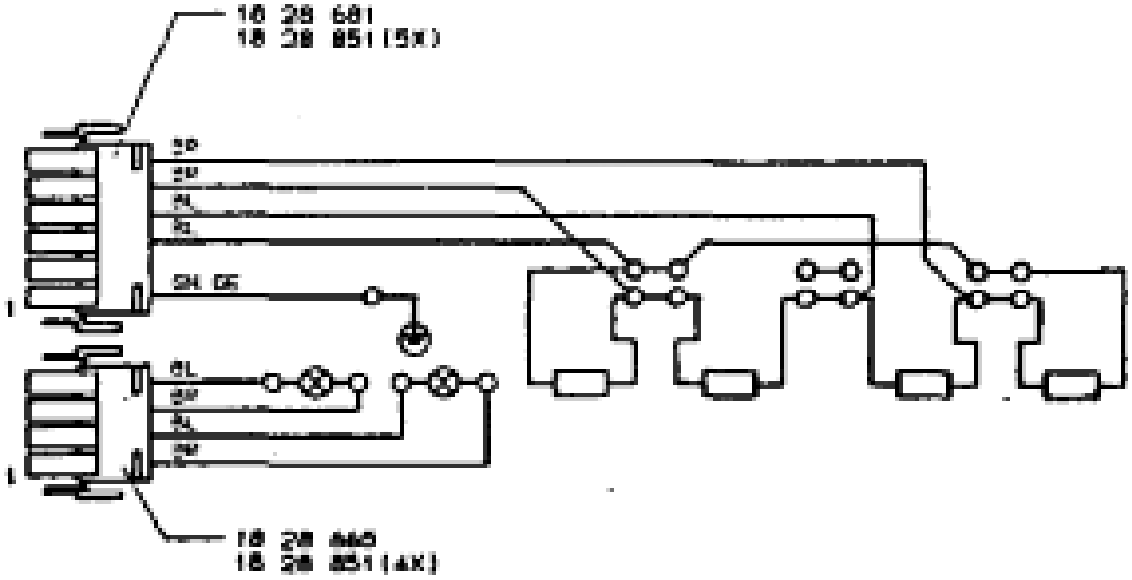
6.5.2 Relay PCB 83 05 951

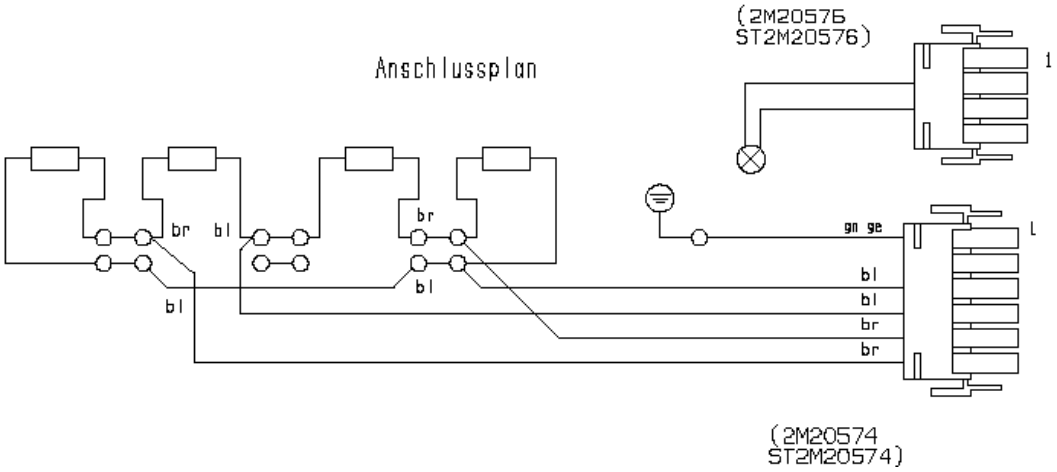
6.5.2.1 Layout





6.5.2.2 Description of connectors





6.5.3 Repair information / state of modifications

6.5.3.1 Repair of PCB Relay 43 01 491

This card cannot be delivered as a spare part, in case where repairs are necessary, the omponents on the card must be renewed:

K1	Semiconductor relay	16 31 399
K2	Relay 24V / 6A	18 21 474

Assembly of this card is identical with the PCB relay 83 05 951.

6.5.3.2 Repair of PCB Relay 83 05 951

This card is available as a spare part, exchange of the components is also possible:

K1	Semiconductor relay	18 31 399
K2	Relay 24V / 6A	18 21 474

Assembly of this card is identical with the PCB relay 83 01 491.

6.6 Display PCB with keypad

6.6.1 Functional test

A functional test is only possible together with all assemblies of the radiant heater.

6.7 Motherboard PCB

6.7.1 Functional test

A functional test is only possible together with all assemblies of the radiant heater.

7 Repair information and change status

7.1 Radiant Heater swivel bearing

Reason: It is very difficult to swivel the bearing out of its latched position after extensive use.

Cause: Wear

Remedy: If necessary, mount improved swivel bearing 2M 18 652

Please note: The 4 fixing screws of the radiant heater RH 600 shall be secured with Loctite 221 (P/N 79 01 966) in the course of servicing!

8 Special test equipment for RH600

Skintemperature - Sensorsimulator for 32.2 / 36.0 / 37.8 °C	79 01 236